



RAD51 gene

RAD51 recombinase

Normal Function

The *RAD51* gene provides instructions for making a protein that is essential for repairing damaged DNA. Breaks in DNA can be caused by natural and medical radiation or other environmental exposures, and also occur when chromosomes exchange genetic material in preparation for cell division. The RAD51 protein binds to the DNA at the site of a break and encases it in a protein sheath, which is an essential first step in the repair process.

In the nucleus of many types of normal cells, the RAD51 protein interacts with many other proteins, including BRCA1 and BRCA2, to fix damaged DNA. The BRCA2 protein regulates the activity of the RAD51 protein by transporting it to sites of DNA damage in the nucleus. The interaction between the BRCA1 protein and the RAD51 protein is less clear, although research suggests that BRCA1 may also activate RAD51 in response to DNA damage. By helping repair DNA, these three proteins play a role in maintaining the stability of a cell's genetic information.

The RAD51 protein is also thought to be involved in the development of nervous system functions that control movement, but its role in this development is unclear.

Health Conditions Related to Genetic Changes

breast cancer

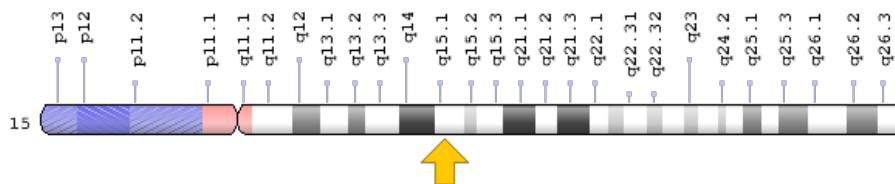
congenital mirror movement disorder

At least four *RAD51* gene mutations have been identified in people with congenital mirror movement disorder, a condition in which intentional movements of one side of the body are mirrored by involuntary movements of the other side. These mutations change single protein building blocks (amino acids) in the RAD51 protein sequence, or introduce a premature stop signal in the instructions for making the protein, resulting in an impaired or missing protein. It is unknown how this shortage of functional RAD51 protein affects nervous system development and results in the signs and symptoms of congenital mirror movement disorder.

Chromosomal Location

Cytogenetic Location: 15q15.1, which is the long (q) arm of chromosome 15 at position 15.1

Molecular Location: base pairs 40,694,774 to 40,732,340 on chromosome 15 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- BRCC5
- DNA repair protein RAD51 homolog 1
- HRAD51
- HsRAD51
- RAD51 homolog (RecA homolog, *E. coli*) (*S. cerevisiae*)
- RAD51 homolog (*S. cerevisiae*)
- RAD51_HUMAN
- RAD51A
- RECA
- RecA-like protein
- RecA, *E. coli*, homolog of
- recombination protein A

Additional Information & Resources

GeneReviews

- Congenital Mirror Movements
<https://www.ncbi.nlm.nih.gov/books/NBK279760>

Scientific Articles on PubMed

- PubMed

<https://www.ncbi.nlm.nih.gov/pubmed?term=%28RAD51%5BTI%5D%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D>

OMIM

- RAD51, S. CEREVISIAE, HOMOLOG OF
<http://omim.org/entry/179617>

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
http://atlasgeneticsoncology.org/Genes/GC_RAD51.html
- ClinVar
<https://www.ncbi.nlm.nih.gov/clinvar?term=RAD51%5Bgene%5D>
- HGNC Gene Family: Fanconi anemia complementation groups
<http://www.genenames.org/cgi-bin/genefamilies/set/548>
- HGNC Gene Symbol Report
http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=9817
- NCBI Gene
<https://www.ncbi.nlm.nih.gov/gene/5888>
- UniProt
<http://www.uniprot.org/uniprot/Q06609>

Sources for This Summary

- Cousineau I, Abaji C, Belmaaza A. BRCA1 regulates RAD51 function in response to DNA damage and suppresses spontaneous sister chromatid replication slippage: implications for sister chromatid cohesion, genome stability, and carcinogenesis. *Cancer Res.* 2005 Dec 15;65(24):11384-91.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/16357146>
- Depienne C, Bouteiller D, Méneret A, Billot S, Groppa S, Klebe S, Charbonnier-Beaupel F, Corvol JC, Saraiva JP, Brueggemann N, Bhatia K, Cincotta M, Brochard V, Flamand-Roze C, Carpentier W, Meunier S, Marie Y, Gaussem M, Stevanin G, Wehrle R, Vidailhet M, Klein C, Dusart I, Brice A, Roze E. RAD51 haploinsufficiency causes congenital mirror movements in humans. *Am J Hum Genet.* 2012 Feb 10;90(2):301-7. doi: 10.1016/j.ajhg.2011.12.002. Epub 2012 Feb 2.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/22305526>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3276668/>

- Franz EA, Chiaroni-Clarke R, Woodrow S, Glendining KA, Jasoni CL, Robertson SP, Gardner RJ, Markie D. Congenital mirror movements: phenotypes associated with DCC and RAD51 mutations. *J Neurol Sci.* 2015 Apr 15;351(1-2):140-5. doi: 10.1016/j.jns.2015.03.006. Epub 2015 Mar 10.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/25813273>
- Gallea C, Popa T, Hubsch C, Valabregue R, Brochard V, Kundu P, Schmitt B, Bardinet E, Bertasi E, Flamand-Roze C, Alexandre N, Delmaire C, Méneret A, Depienne C, Poupon C, Hertz-Pannier L, Cincotta M, Vidailhet M, Lehericy S, Meunier S, Roze E. RAD51 deficiency disrupts the corticospinal lateralization of motor control. *Brain.* 2013 Nov;136(Pt 11):3333-46. doi: 10.1093/brain/awt258. Epub 2013 Sep 20.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24056534>
- GeneReview: Congenital Mirror Movements
<https://www.ncbi.nlm.nih.gov/books/NBK279760>
- Kawabata M, Kawabata T, Nishibori M. Role of recA/RAD51 family proteins in mammals. *Acta Med Okayama.* 2005 Feb;59(1):1-9. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/15902993>
- Klar AJ. Selective chromatid segregation mechanism invoked for the human congenital mirror hand movement disorder development by RAD51 mutations: a hypothesis. *Int J Biol Sci.* 2014 Sep 10; 10(9):1018-23. doi: 10.7150/ijbs.9886. eCollection 2014. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/25210500>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4159693/>
- Méneret A, Depienne C, Riant F, Trouillard O, Bouteiller D, Cincotta M, Bitoun P, Wickert J, Lagroua I, Westenberger A, Borgheresi A, Doummar D, Romano M, Rossi S, Defebvre L, De Meirleir L, Espay AJ, Fiori S, Klebe S, Quélin C, Rudnik-Schöneborn S, Plessis G, Dale RC, Sklower Brooks S, Dziezyc K, Pollak P, Golmard JL, Vidailhet M, Brice A, Roze E. Congenital mirror movements: mutational analysis of RAD51 and DCC in 26 cases. *Neurology.* 2014 Jun 3;82(22):1999-2002. doi: 10.1212/WNL.0000000000000477. Epub 2014 May 7.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24808016>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4105259/>
- Pellegrini L, Yu DS, Lo T, Anand S, Lee M, Blundell TL, Venkitaraman AR. Insights into DNA recombination from the structure of a RAD51-BRCA2 complex. *Nature.* 2002 Nov 21;420(6913):287-93. Epub 2002 Nov 10.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/12442171>
- Peng J, Charron F. Lateralization of motor control in the human nervous system: genetics of mirror movements. *Curr Opin Neurobiol.* 2013 Feb;23(1):109-18. doi: 10.1016/j.conb.2012.08.007. Epub 2012 Sep 16. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/22989473>

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